WQPN 6, February 2006

Vegetation buffers to sensitive waters

Purpose

Native vegetation buffers to estuaries, reservoirs, watercourses, wetlands and production wells (drawing from the water table aquifer) provide the following environmental benefits:

- A filter that helps protect surface waters from pathogens, turbidity, nutrient-enriched run-off and waterborne spread of weed species. Buffers are particularly important down gradient of erosive soil such as disturbed land and unpaved roadways.
- Slow water movement into waterbodies, allowing time for remedial action in the event of chemical spills.
- Vegetation roots protect waterway banks from erosion and slow the progress of floodwaters.
- Provide a physical and visual barrier to limit unnecessary human and domestic animal access to sensitive waterways.
- Support waterway ecology by shading waters, providing food and habitat for aquatic fauna eg a natural source of food from leaf litter and shelter provided by fallen branches.
- Provide a home and migration corridors for native fauna.

Clean water resources used for drinking water, support to local ecology and social or commercial benefits, along with breathable air, rank as the most fundamental and important requirements to sustain communities. These water resources need to remain within defined quality limits to retain their value, and therefore need adequate protection. Many wetlands and waterways in WA have lost native vegetation margins, which increases the risk of contaminants entering the waterbody and causing fish deaths, turbidity, degraded water quality and algal blooms. This department supports retention, protection and where necessary restoration of adequate vegetated buffers between any land use activities that may pose a contamination risk and the margins of the State's surface and groundwater resources, as part of the State's water quality management strategy. A further aim of this note is to improve people's awareness of the need for vegetated buffers to both surface waterbodies and groundwater extraction points as an essential protective contaminant barrier to sustain the quality of these waters and maintain their values.

Vegetated buffers are key strategic elements among a series of protection barrier options that reduce the risk of contaminant impact on water quality. Other barriers include risk-awareness programs, risk avoidance (less contaminating materials used), land use activity constraints, spill containment facilities, best practice application controls for agricultural chemicals, spill-related intervention strategies, soil amendment to attenuate contaminants in the environment, wastewater treatment accompanied by monitoring, and isolation of contaminated waters.

The buffer retention objective may conflict with existing approved land uses, and raise social and economic challenges that present difficulties in the short term. This note aims to present technical information on buffer issues and help to define appropriate buffers to land use activities that may pose a threat to water quality.

The Department of Water is responsible for managing and protecting the State's water resources. It is also a lead agency for water conservation and reuse. This note offers:

- the Department's current views on establishing and maintaining protective vegetated buffers to vulnerable surface waterbodies to help sustain their values;
- guidance on acceptable practices used to protect the quality of Western Australian water resources; and
- a basis for the development of a multi-agency code or guideline designed to balance the views of industry, government and the community, while sustaining a healthy environment.

This note provides guidance on issues of environmental concern, and offers potential solutions based on professional judgement and precedent. Its use does not override any statutory obligation or Government policy statement. Alternative practical environmental solutions suited to local conditions may be considered. Recommendations provided should not be used by regulators in place of a site-specific assessment of any project's environmental risks. Any conditions set should consider the values of the surrounding environment, the safeguards in place, and take a precautionary approach. This note shall not be used as this Department policy position on a specific matter, unless confirmed in writing by the Department. The note may also be varied at our discretion, as new data becomes available.

Where a conflict arises between this Department recommendations and any proposed activity within a sensitive environment, the note may be used to assist negotiations with stakeholders. This Department's position is that the project proponent must demonstrate for diminished buffers that other protection measures ensure there is a lesser risk to water resource quality and the sustainability of downstream ecosystems, than if the recommended buffers were used.

Scope

This note provides guidance on retaining, maintaining and where necessary re-establishing vegetated buffers between land use activities (ie commercial, industrial, recreational, rural or residential uses) and sensitive water resources managed to retain their value for the community. Sensitive water resources are described in Appendix C.

Recommenda t ions

Form of buffers

This Department aims to promote and progressively foster the re-establishment and maintenance of vegetated buffers to waterbodies and gain broad acceptance of their value within the community. Buffer dimension selection tends to be controversial and may require a balanced outcome negotiated between competing interests. Buffer re-establishment within freehold land could affect land values and productivity in both rural and urban settings. Buffer form and dimensions may vary from site to site and sometimes within a particular site, depending on local conditions, risk mitigation measures proposed for projects, relative resource and community-driven values, length of time that the buffer needs to be effective and availability of resources. This leads to a range of buffer options which are discussed in this note.

1. *Vegetation retention* of existing undisturbed local provenance native plants should be standard practice beside waterways, wetlands and estuaries, where practical.
2. *Restoration of native vegetated buffers* which have been degraded or removed, should (where practical be restored) with native vegetation equivalent in type, form, density, and diversity to that occupying the area prior to land development. Planted buffers should consist of a mix of native trees, shrubs and groundcover. These buffers should be sustainable, with the least practical need for human intervention. Management activities may periodically be necessary to remove exotic weeds, for hazard reduction to prevent wild-fires and ensure public safety. More information on this topic is provided later under *Restoration of degraded buffers.*

3.

10. *Roads or service corridors* may cross buffer zones, but these should occupy the minimum practical area of the buffer. Necessary measures should be installed eg fencing to limit human and livestock intrusion, and stormwater management systems to limit deterioration of the buffer and the protected waters.
11. *Unpaved roads* pose a risk to waterbodies due to stormwater causing surface erosion and associated water channelling which increases the rate of contaminated water movement. Unpaved roads include public and private roads, logging tracks, mining roads, road-work deviations, and access tracks for surveillance and fire-fighting purposes. Roads (where essential) should cross buffers at right angles to the stream alignment and include run-off distribution channels to drain turbid water into filter vegetation. Appendix D displays a typical layout of protective drainage measures. Pedestrian and bridle trails normally do not require drainage controls unless containing long runs with steep gradients.
12. *Turf buffers* to waterbodies (while preferred to bare soil), in rural settings are not well suited as filters for protecting surface water resource quality because:
    a. shallow turf root systems offer a low level of stability to waterway banks;
    b. significant maintenance effort is needed ie seasonal watering and mowing;
    c. periodic application of nutrients and pesticides is needed to maintain visual appeal, with the resultant risk of leaching harmful residues into waterbodies;
    d. they encourage human and animal access into surface waterbodies which may pose risks to water quality principally from litter, pathogens and turbidity; and
    e. they don't offer shading, protective habitat or detritus needed to support diversity of aquatic life.

    Constructed or rehabilitated natural wetlands adjacent to waterways or within the floodplain can assist with contaminant attenuation.

13. Factors influencing selection of buffer dimensions
    a. *Current environmental values* of the water resource requiring protection should be defined using the recommendations given in *National Water Quality Management Strategy* (see Appendix A, reference 1). These values are progressively being defined in regional Natural Resource Management Strategies (see www.nrm.org.au). Definition of values should consider present dependencies, their local prevalence, water resource condition, potential implications of water pollution incidents, costs of corrective action and social needs. If the resource has been historically degraded and is subject to a restoration strategy, the target environmental values and buffer restoration may be influenced by the needs of both the local and wider community. Where water values have not yet been determined, the minimum default buffer dimensions described in this note should be used.
    b. *For waters with multiple environmental values*, the largest buffer dimension determined should prevail.
    c. *The nature and significance of risks to waters* posed to water values by land use activities should be determined. The type of contaminant (eg harmful pathogens, turbidity, nutrients, agricultural chemicals, petroleum hydrocarbons, and surfactants), the projected chemical contaminant load (normally expressed as kilograms /hectare/year), travel paths, seasonal variability of contaminant movement, and the level of control on contaminant loss exerted by the activity operator should be assessed.
    d. *Flooded margin variability* for the surface waters being protected. For surface waters, the edge of the flooded area may vary seasonally or in response to stormwater management systems. Groundwater levels also rise and fall seasonally in response to rainfall, evapo-transpiration and water extraction.

e. *Significance of any contaminant discharge* to the water resource. Effects may be both environmental (ie affect the wellbeing of humans, animals or plants), social (eg people may lose confidence in the management of the resource) and economic (eg result in the loss of the resource to agricultural or industrial users).

f. *Local practicalities* may influence the buffer form and dimensions eg poorly defined water values, local site constraints, economics, restoration timelines and practicality of measures necessary to restore a waterbody should contaminant loads cause harm. In remote areas of the State (eg the North West) where cyclonic event rainfall may periodically flood large areas, buffers should match natural riparian conditions that would prevail if human activity were not present. Intervention may only be necessary where water values are defined and land use pressures on waters are evident.

g. *Effects of water contamination* on individuals and the community in the event of short term or permanent loss of downstream water resource values (eg disruption to ecosystems, harm to people, animals or crops, economic loss – production or land values, or reduced aesthetic appeal).

h. *Technical considerations* including local meteorology, hydrology, topography, vegetation

r. *Planning or other environmental functions* that the buffer may need to perform including air quality (dust), aesthetic, bio-security or noise barrier, water access deterrent, community lifestyle benefit, terrestrial ecosystem maintenance function or native fauna shelter belts.

s. *Precedents for buffers* set at similar sites and for similar land uses, and other buffers or setbacks present at the site.

14. If exotic vegetation of significant commercial value (eg crops or plantation timber) presently occupies a buffer, local provenance native vegetation buffer as described should be re-established as soon as practical following harvest. This Department's advice should be sought prior to the use of any chemicals (eg fertilisers or pesticides) near sensitive waters.

15. Default buffer dimensions may be varied at this Department's discretion, based on water resource management data, local environmental factors, perceived operator performance and the assessed level of risk to the water resource. Intermittent breaks in the continuity of buffers (typically around 20 metres in width) are acceptable to allow for road and services access/ crossings and wildfire control.

16. Stormwater management systems should be used where overland run-off of waters with suspended particles is likely to occur, eg vegetated filter strips or constructed flow velocity controls such as sedimentation structures/ areas, should be installed and maintained upstream of the buffers to control sediment flow and deter smothering of buffer vegetation.

17. Further research is desirable on buffer form, dimensions, and efficiency in various climatic conditions, soils, vegetation types and terrains. Monitoring of water quality to assess buffer performance in attenuating pathogens, sediment, nutrients and toxic residues is recommended. This may lead to revised guidance on buffer form and dimensions for maintenance of defined environmental values.

18. Decisions on buffer extent and placement may be determined in the field by experienced environmental personnel after considering local conditions. A written record of the factors leading to variations to accepted buffer protocols should support such decisions.

Buffer defini t ion t

Water supply source protection buffers are ideally determined using local scientific studies. Where these are impractical, empirical practice (as described in this note) may be used to define buffer dimensions. Minimum default water source buffers are proposed in Table 1. This data should assist negotiations, allow for consideration of local environmental and social factors, focus on the relationship between buffer benefits to water resource quality versus the costs of loss of productive land at individual sites, foster timely decisions and alleviate disputes.

Wi t hin Pubic Drinking Wa t

Public Drinking Water Source Area (PDWSA) is the collective name given to catchments declared to manage and protect any water source used for public drinking water supplies. PDWSAs describe areas defined under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947*. PDWSAs include Underground Water Pollution Control

25. The diagrammatic representation of typical buffer configurations linked to stream order (ie number of stream tributaries) is provided at Appendix D.

26. Specific buffer dimensions may consider the number of stream tributaries and their relative proximity to water sources, the anticipated need for protection of water-based biota and perceived difficulty of effective intervention if contaminants do cross the buffer. Recommended buffer widths may reduce according to the risk level of contamination to water resources. Any buffer reduction should consider the distance from the protected waterbody, extent of protective measures employed and the ability to detect hazards and effectively intervene prior to a significant contamination event.

Wa t er ay and iw t

27. Five Waterways Management Areas have been declared to provide special protection ared to-13(-7(a)-3(n

www.water.wa.gov.au
Telephone: (08) 6364 7600
Facsimile: (08) 6364 7601
Floor 4, The Atrium
168 St Georges Terrace Perth
Western Australia 6000

www.environment.wa.gov.au
Telephone: (08) 6364 6500
Facsimile: (08) 6364 6525
Floor 4, The Atrium
168 St Georges Terrace Perth
Western Australia 6000

Appendices

Appendix A References and further reading

1. Australian Government - National Water Quality Management Strategy

   a. ANZECC, ARMCANZ- *Australian and New Zealand Guidelines For Fresh and Marine Water Quality,* 2000*;*

   b. ANZECC, ARMCANZ- *Australian Guidelines for Water Quality Monitoring and Reporting,* 2000*;*
      see web page www.deh.gov.au/water/quality/nwqms/index.html.

   c *ARMCANZ, NHMRC-* *ARMCANZ, 2000 teg www.g W .002n 0.002 Tw [(w)3(w)3(w)14(.)-7a2 0 Tdtsg D (c.)Tj 0.772 0 Tc*

Appendix C - Sensitive water

Clean water resources, used for drinking water, sustaining aquatic and terrestrial ecology, industry and aesthetic values, along with breathable air, rank as the most fundamental and important needs for viable communities. These water resources should remain within specific quality limits, and therefore require stringent and conservative protection measures. Guidance on water quality parameters necessary to maintain water values are published in the *National Water Quality Management Strategy Guidelines* (see web site www.deh.gov.au/water/quality/nwqms/index.html).

This Department strives to improve community awareness of catchment protection measures for surface water and groundwater aquifers as part of a multi-barrier protection approach to maintain the quality of water resources and their values.

To be considered sensitive, water resources must support one or more of the environmental values described below. Any activity or a land use will pose a risk to water quality if contaminants are able to be washed or leached into sensitive water resources in discernible quantities. These water resources include shallow groundwater accessed by water supply wells, surface waterways, estuaries, or wetlands. Community support for these values, setting of management objectives for water resources and implementation of a practical attainment strategy are seen as key elements in protecting and restoring the values of these water resources.

Sensitive water resources include:

a. Those proclaimed or assigned as Public Drinking Water Source Areas (ie Water Reserves, Catchment Areas or Underground Water Pollution Control Areas) via the *Metropolitan Water Supply, Sewerage and Drainage Act 1909*, the *Country Areas Water supply Act 1947* or the *Health Act 1911.*

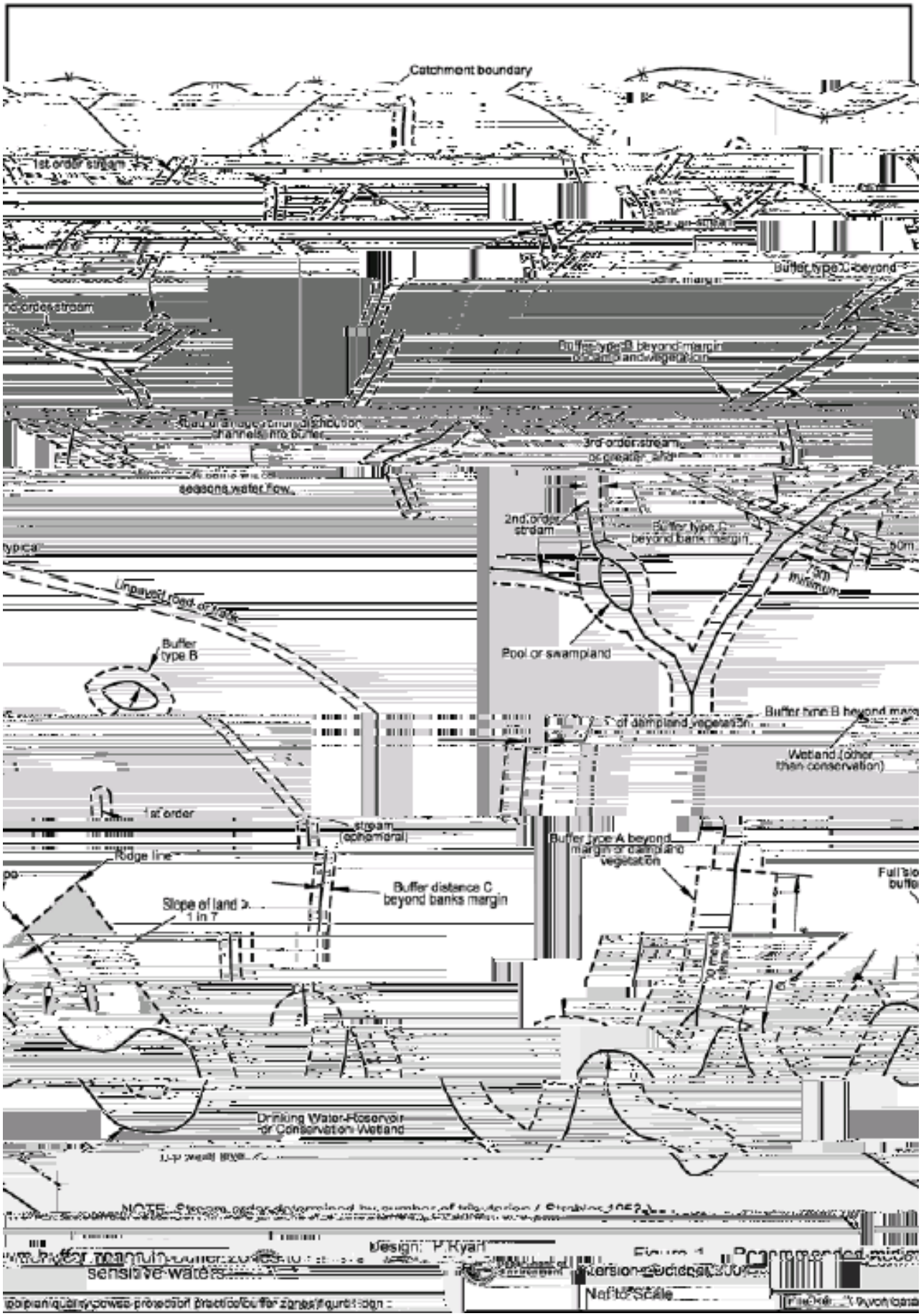
b. Those used as private drinking water supply sources (ie for human or stock consumption).

c. Waters with specific quality necessary to support commercial or industrial activities eg aquaculture, food processing or crop irrigation.

d. Wetlands and waterways – pristine or conservation-valued, detailed as follows:
   - areas covering water resources defined via the *Environmental Protection Act 1986,* Part III eg *Environmental Protection (Swan Coastal Plain Lakes) Policy1992;.*
   - waterways managed under the *Waterways Conservation Act 1976*, ie the Avon, Peel-Harvey, Leschenault, Wilson Inlet and Albany Waterways Management Areas;
   - the Swan-Canning Estuary and adjoining lands managed via the *Swan River Trust Act 1988*;
   - wetlands of regional, national and international importance, including but not limited to: Conservation category wetlands and Resource Enhancement category wetlands and wetlands listed within *A Directory of Important Wetlands in Australia* (see the Australian Department of Environment and Heritage web site which also provides information on Ramsar convention sites) www.deh.gov.au/water/wetlands/database/directory; and
   - groundwater aquifers that sustain important ecological functions.

e. Locations where surface water or groundwater from the water table may be consumed or inhaled affecting people's health or well-being, eg garden, recreation or irrigation sources.

f. Surface waterbodies and wetlands meeting recognised cultural or social needs, eg water resources used for community swimming, fishing or valued for their visual appeal.


Catchment boundary
1st order stream
Buffer type C beyond
2nd order stream
Buffer type B beyond margin
3rd order stream
Buffer type C beyond banks margin
Pool or swampland
Buffer type B
Wetland (other than conservation)
1st order
stream (ephemeral)
Ridge line
Buffer distance C beyond banks margin
Slope of land
1 in 7
Buffer type A beyond margin of dampland vegetation
Drinking Water Reservoir or Conservation Wetland
Design: P Ryan
sensitive waters
Not to Scale